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Opinion Article

Mechanism of Electro Dialysis (ED) and its Applications

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DESCRIPTION

Electro Dialysis (ED) is used to transport salt ions from one solution to another solution through ion exchange membrane under the influence of an applied electric potential difference. This is done in a configuration is called as electro dialysis cell. This cell consists of a dilute and brine compartment formed by an anion exchange membrane and a cation exchange membrane placed between two electrodes. In all practical electro dialysis techniques, multiple electro dialysis cells are arranged into a configuration is known as Electro Dialysis Cell (EDC), with alternating anion and cation exchange membranes forming the multiple electro dialysis cells. Electro dialysis process is different from distillation techniques and other membrane based processes, such as Reverse Osmosis (RO) in which dissolved species are moved away from the feed stream rather than the reverse osmosis. As the amount of dissolved species in the feed stream is lower than that of the fluid, electro dialysis offers the practical advantage of higher feed recovery in many applications.

Electro dialysis is a technique controlled by an electric field gradient that allows the separation of minerals from the feed water solution. It moves dissociated ions through ion-perm-selective membrane and forms two different flows, which is a desalinated flow is known as diluate and a concentrated flow is known as concentrate (brine). It is a membrane based technique involving the transport of ions through semi-permeable membranes by using an applied electric field.

APPLICATIONS OF ELECTRO DIALYSIS

Applications of electro dialysis include desalination, table salt production, and wine stabilization. In an Electro Dialysis Cell (EDC), the dilute feed stream (D), the concentrate stream (C), and the electrode stream (E) are allowed to flow through the appropriate cell compartments formed by the ion exchange membranes. Under the influence of an electrical potential difference, and negatively charged ions for example chloride in the dilute stream migrate to the positively charged anode. These ions pass through the positively charged anion exchange membrane, but the negatively charged cation exchange membrane prevent them from migrating further to the anode and thus they remain in the C stream, which is enriched with the anions.

The Positively charged ions for example sodium in the D-stream migrate to the negatively charged cathode by passing through the negatively charged cation exchange membrane. These cations also stay in the C stream, as prevented from further migration towards the cathode by the positively charged anion-exchange membrane. As a result of the anion and cation migration, electric current flows between the cathode and anode. Only an equal number of anion and cation charge equivalents are transferred from the stream D into the stream C, so that the charge stability is maintained in each stream. The overall result of the electro dialysis process is an ion concentration increase in the brine stream with a depletion of ions in the dilute solution feed stream.

The Cation Exchange Membranes (CEM) is a selective barrier separating the anode and cathode compartments. The function of this membrane is to be selectively permeable to cations, preferably protons moving from the anode to the cathode. Cation Exchange Membranes (CEM) are proton conductive polymer film is also called as electrolytes or ionomer that allows only protons to cross-over (cation exchange), which is the key function of proton exchange membrane fuel cells and water electrolyzes. Cation-exchange resins are used to treat hyperkalemia by accelerating potassium loss through the gut, especially when there is a lack of urine production or before dialysis which is the most effective method of treating hyperkalemia. The membranes are cation or anion selective, which means that both positive ions and negative ions will flow through. Cation-selective membranes are poly electrolytes with the negatively charged matter, which rejects negatively charged ions and allows positively charged ions to flow through.

Anion Exchange Membrane (AEM) is the process in which anions in the form of acids are adsorbed through a basic substance. It describes the exchange of ions in which one anion (as chloride) is substituted for one or more anions (as sulfate). It

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is highly effective on negatively charged ions such as: Bicarbonate, and Nitrates. Anion Exchange Chromatography (AEC) is a form of Ion Exchange Chromatography (IEX), which is used to separate molecules based on their internet surface charge. Anion exchange chromatography is more specifically, uses a positively charged ion exchange resin with an affinity for molecules having internet negative surface charges.